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ScienceDirect

Procedia Social and Behavioral Sciences 18 (2011) 372–378

Procedia Social and Behavioral Sciences

Kongres Pengajaran dan Pembelajaran UKM, 2010

The Effectiveness of Simulation Based Medical Education In Teaching Concepts of Major Incident Response

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Abstract

We conduct a study to see the students confident and perceived understanding in the management of major incident response. We conducted a cross sectional questionnaire-base study on a group of 45 medical students who underwent their Emergency Medicine posting in UKMMC. They were given an hour lecture on major incident response and followed with a moulage exercise that consists of scene response, in-hospital management and a mock press conference. A 14 point questionnaire using a 5-point Likert scale was developed and used to gauge the perceived level of understanding and confidence among the respondents in the 7 principles areas of managing a major incident as outlined in the Major Incident Medical Management and Supports (MIMMS). The result was analyzed using a paired-T test to compare the mean score of pre- and post exercise. The results showed Simulation Based Medical Education (SBME) improved in the level of understanding in all the 7 areas of major incident response with the median score of 3/5 to 4/5 in pre and post-exercise respectively. The confident level also showed improvement from pre- to post-exercise in all areas except in communication (using the 2-way radio). Overall, there was statistically significant increase in term of understanding (t value = 5.596; p = 0.001) and confident level (t value = 5.259; p = 0.002) from pre- to post-moulage exercise. The students rated that their confidence and understanding of the principle of major incident management has improved considerably following the moulage session. Further studies are recommended by the authors on the value of using high fidelity SBME for Disaster Medicine education in undergraduates.

Selection and/or peer-review under responsibility of Kongres Pengajaran & Pembelajaran UKM, 2010

Keywords: confident level; simulation; major incident response;

1. Introduction

Major incident is a catastrophe that should be mitigated well and early in order to reduce the loss of life and its effect. According to Center for Research on Epidemiology of Disaster (CRED) disaster is define as situations or events that overwhelm local capacity, necessitating a request to national or international level for external assistance (Vos et al, 2009) . It has to meet at least one of these four criteria before it can be declared as a disaster which is 1) ≥ 10 people killed; 2) At least 100 people affected; 3) A call for international events; or 4) declaration of a state of emergency by the authority.

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1877–0428
doi:10.1016/j.sbspro.2011.05.053

Since the past century the incidents of disaster or major incident is ever increasing (Eshghi et al 2008). Even though health care providers play important roles during any major incident event unfortunately a lot of them were unprepared and the number trained to response is quite limited (Alexander et al 2005; Berman et al 2003, Greenberg 2002, Kaji 2003). Disaster Medicine is now an emerging branch of the medical sciences, focusing on the various aspects of health care in disaster situations from scene management, incident command systems, triage, treatment and transport, to emergency department and definitive care including public health measures and epidemiological methods. In 2008, healthcare response to disasters was described by Kirsch et al. (2008) as ever evolving and that the discipline of Disaster Medicine has migrated from a knowledge base of anecdotal "response reports" to scientific methodology. In addition to this there has been an emphasis on preparedness and mitigation strategies. Central to this is the development of several training methods. Most of these training courses were designed for experienced health care professionals for example Major Incident Medical Management and Support (MIMMS) (Hodgetts 2002), EmergoTrain System (ETS) and Hospital Preparedness (HoPe).

Most medical curricula do not incorporate principles of Disaster Medicine. Sinha et al (2008) described there was insufficient knowledge, attitude and practice medical undergraduates in India about disaster and disaster preparedness. Incorporation of education and training of Disaster Medicine in National University of Malaysia (*Universiti Kebangsaan Malaysia* - UKM) medical undergraduates was implemented under the new revised curriculum. It was part of the Emergency Medicine Module to the final year medical undergraduates. This paper presents the medical student opinions towards this new topic in term of understanding and their level of confidence in disaster medicine.

2. Method

A prospective cross sectional study was carried out among 45 fifth year medical undergraduates in Universiti Kebangsaan Malaysia Medical Center (UKMMC) undergoing emergency medicine posting. They were given a 90 minutes concept lecture on disaster risk management followed by 3 hours practical sessions on radio communication, field triage and transport of an injured victim.

Three hours disaster moulage was then designed depicting a major incident of explosion that occurred in a night club involving 15 victims. The conduct of the moulage was divided into four (4) phases which were 1) Scenario planning and setting up learning objective, 2) Scenario preparation including victim make-up and scene mock-up, 3) Scenario execution and 4) Debriefing.

In scenario planning, a group of lecturers discussed and decided on suitable scenario/ trigger to be carried out which in line with the course learning outcomes. A more detail learning outcomes pertaining to the disaster response were outline to the 7 principles of disaster response. Number of victims, scene selection, team divisions (rescuers, hospital team, and support staff) was identified. The roles of each team were also outlined.

In scenario preparation, three important elements were 1) Victims make-up, 2) Scene mock-up and 3) Students briefing. All these were done simultaneously by three different teams. In victims' make-up, locally available materials were used to mock the injuries in each victims i.e. laceration, abrasion, hematoma, open and closed fracture, evisceration, burns, amputations etc. Mocking up the selected scene were carefully done using props and available resources. A short briefing on the roles of each students, safety aspects and precaution to be taken were stressed prior to execution.

During execution, the students played their role either as pre-hospital responders, hospital team, victims and support staff which include reporters, security, relatives, etc. The scenario starts with a call-in informing the pre-hospital team regarding a major incident. In this exercise, it was terrorist-related explosion of a night club involving 15 victims with various injuries. The pre-hospital team was then expected to response adhering to the principles of major incident response which include Command and Control, Safety, Communication, Assessment, Triage, Treatment and Transport.

Scene management was done and victims were transported to a field hospital using the techniques learned. In-hospital management was then delivered to the victims and scenes. These activities were assessed by a group of lecturers. Several video cameras were also used to capture salient teaching-learning issues according to the 7-principle areas. A mock press conference was held at the end of the exercise.

During debriefing, video clips and photos taken were shown to the students and commented on by the lecturers. The students were asked to give feedback why they took certain actions and what they understand from it. Discussion was directed to the learning objectives.

Student understanding and confidence was assessed using a 14-point questionnaire with response according to 5-point Likert scale. The questionnaire was designed to address the 7 principles of major incident response, which is the main concern of the learning issues, as mention above. The validated questionnaire was self-filled by the students before the moulage session. After the exercise and debriefing, they were again asked to fill the similar questionnaire.

Data were collected and entered into SPSS Ver. 16.0. Statistical analysis was performed using median descriptive on the perception of understanding of the 7 principles. On the other hand, student paired t-test was used to compare the mean between the group pre and post-moulage in terms of perception of understanding and level of confidence.

3. Results

All forty five students completed disaster moulage and answered the pre and post-moulage questionnaire. Table 1 showed the baseline characteristics of the sample.

Table 1. Demographic data

Demographic	Medical students (n=45)
Median Age	24 (22-25)
Sex	
Male	42.2% (19)
Female	57.8%(26)
Race	
Malay	64.4 (29)
Chinese	35.6 (16)

Figure 1 described the primary objective of the study. There was significance difference ($p<0.05$) in mean score of the students perception on understanding the principles of disaster response between pre- and post-moulage in the areas of command and control, safety, assessment, triage and transport of victims. Only two areas that showed no significance difference ($p > 0.05$) between pre and post group, which are communication and treatment.

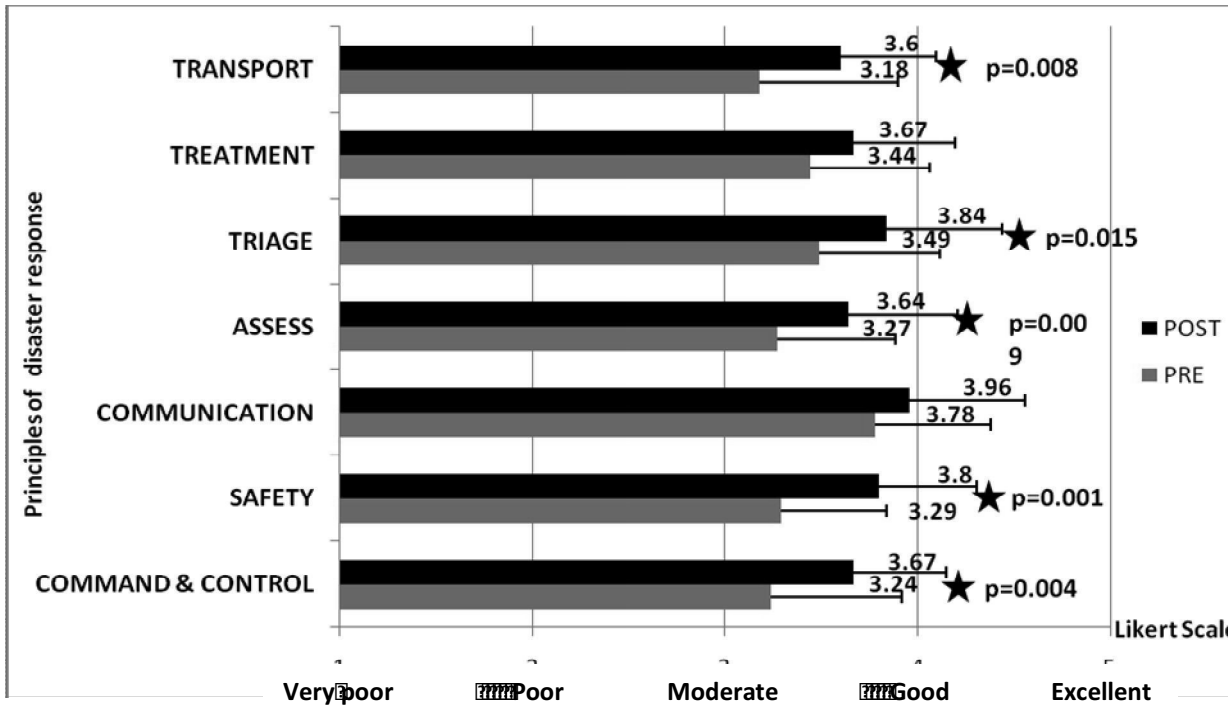

Figure 1 Mean score on perception of understanding between premoulage and post moulage (*p<0.05)

Figure 2 described the secondary objective of the study. There was significance difference in mean score medical students' confidence level between pre- and post-moulage in areas of command and control, safet communication, assessment, treatment and transport of victims.

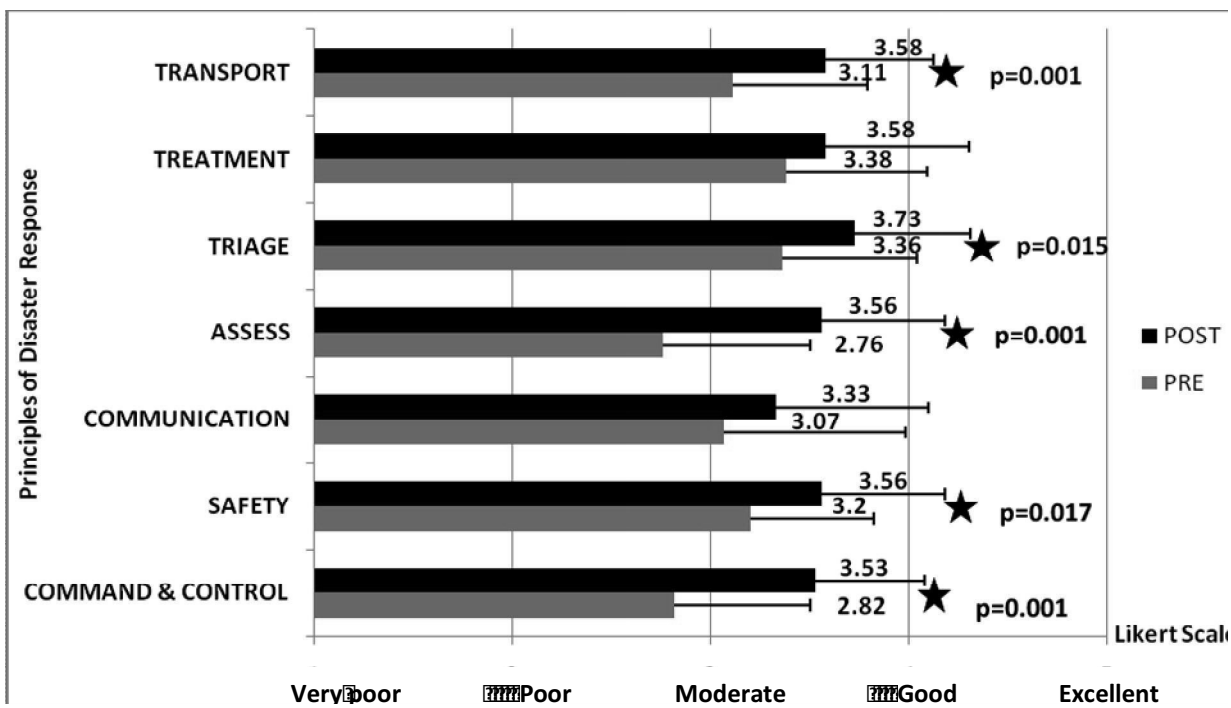

Table 2. Mean total score of perception on understanding and confidence levels of disaster response management pre and post-moulage

	Pre-moulage	Post-moulage
Perception of understanding principles of disaster response management.	3.38 ± 0.21	3.74 ± 0.13
Confidence level in principles of disaster response management	3.10 ± 0.24	3.55 ± 0.11

Table 2 showed there was significance increased in the score for overall perception of understanding among medical students in the principles of disaster response after completion of the moulage (p=0.001) and confidence level after the moulage exercise (p=0.002).

4. Discussion

Introducing major incident response subject into the medical curriculum was really a daunting task since unlike other types of medicine where the availability of clinical cases was quite easily found in the ward or clinic; the same could not be said about disaster. Apart from case availability, since major incidence or disaster occurrence were not something that we can walk into and easily found everyday in one locality, the issue of students and lecturer safety was also something of concerned. Therefore to address these issues of case availability and safety, we utilized simulation base medical education (SBME) as the teaching tool for disaster response in our institution. Setting up major incident simulation or moulage takes a lot of effort from everyone including lecturers, students and especially the preparation team. Therefore, apart from teaching the students we also need to evaluate the students understanding and whether this exercise have any impact on their confidence towards major incidents response. Madge et al (2004) found that majority of responders are not confident when they were face with major incidents.

We found that simulation exercised has significantly improved the overall students understanding and level of confidence in learning the principles of disaster response medicine. In fact previous study has shown that it also prepared students mentally and psychologically (Katz et al 2002). Through simulation, the students will experience the three main learning domains which are the cognitive, psychomotor and affective domain. The students need to use psychomotor skills to elicit the finding, use cognitive domain to interpret and affective domain to handle patient in stress as there will be a presence of emotional component from the victims. That explained the increased in confident level among the students.

This is shown in our result that major incident simulation, were able to increase students understanding in five out of the seven principles areas of disaster response which were command and control, safety, assessment, triage and transport. This is an interesting finding since command and control, safety and assessment are more towards the organizational and conceptual aspect where from our previous experience students found it to be a dry subject and difficult to appreciate it.

To ensure well organized and successful major incidence response the most important step is to have a good command and control of the incidence or situation. A good command and control will set up the correct tone of response and eventually produce a better result. This has been shown in many example of well managed major incident response. Command and control improved in both understanding and confident among medical students through SBME because the concept would be easier to be visualized after the exercised. It involves leadership, giving and taking orders, reporting for duty and making organizational decision.

Experiencing hazard and danger during simulation make them understand safety issue better. If there is no simulation of major incident then the students really need to get involve in hazard that might cause harm to them. Therefore, experiential learning through simulation can help them experience hazard without any real harm and appreciate the value of safety. In the aspect of assessment, the students need to continuously performed scene-size-up. Students perceive they understand better the techniques of scene size up after the simulation. Scene size up consists of hazard assessment, determining if extra resources is needed, assessing number of victims involved,

determining type of incident happened, assessing accessibility to scene and the mechanism involved. Although we did not measure each component objectively but overall the students perceive they understand better and more confidence performing scene size up and other assessment tools.

Triage is a process that not only they required understanding but also skill in order to perform it. These are usually acquired through practice and experience. The students applied the Simple Triage And Rapid Transport (START) system which relies on respiratory rate, heart rate and mental status to sort victims as immediate, delayed or expectant. Through simulation, we set up a real mock scene triage which student can apply what they have learned in a classroom to a mock victim.

The communication is the most important link in any disaster response (Hodgetts et al 2002). Used of a communication device such as two-way radio, need a special training in order to familiarized with it, compared to a normal phone or mobile phone which most students are familiar with. The usage required using a call signs and codes i.e. NATO phonetic alphabets to convey a brief and concise massage. It also need student to be familiar with functions buttons to operate it at the optimal level. This study shows no significant different on students confident level toward communications before and after the simulation exercise. These could be because they have already undergone a hands-on radio communication class few days prior to the moulage which specifically trained them how to use the device. Since during simulation exercise only few students have the chance to use the radio, it is expected that this skill does not show any improvement after the exercise.

In the aspect of treatment, our result showed no improvement even after the simulation activity. In contrast to triage process where there are element of simple cognition and psychomotor involve, treatment on the other hand entails the student to acquire a more complicated cognition and psychomotor process. Not only they need decision making skill but they also need to do the action of treating. This obviously required more training and experience in which these two weeks of ED posting is not adequate. By conducting a special session on giving treatment on major incident victims, that incorporate advance first aid in the medical student curriculum we feel it would likely benefit the students. However, we also noted that students will usually under-rated their treatment ability in other medical posting in our institution.

There are few limitations in this study. Firstly, the number of students enrolled is small and a larger sample size will enhance the results of this study. Secondly, the ‘victims’ was among the students themselves. It would be better if we used simulated patients (SP) as it would reduce biases and feedback can be given objectively to the students by the SPs. Thirdly, questionnaires can be improved further by forming objective questions to measure understanding. Further studies should be done to address these issues. The effectiveness of major incident simulation as a teaching tool should be further assessed especially in the actual understanding and ability to retain the knowledge and skills in major incident management.

5. Conclusion

From this study, we can conclude that teaching disaster response through Simulation Based Medical Education contribute significantly to the perception of understanding and confidence level of medical student. However, communication and treatment aspects of major incident response should be thought separately in order to improve the outcome. Further studies are recommended by the authors on the value of SBME for Disaster Medicine education in undergraduates.

Acknowledgement

The author wish to thank the faculty members Department of Emergency Medicine UKMMC and also the supporting staff from nursing, paramedics and administrative for conducting this study.

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